

CLAIMS:

What is claimed is:

1. A method of generating a tracking error signal using laser beams reflected from a surface of a compact disc, comprising:
detecting the reflected laser beams using a photo detector; and
generating a first tracking error signal based on optical signals received by the photo detector, using a differential phase detection method and outputting the first tracking error signal as the tracking error signal.
2. The method of claim 1, further comprising:
generating a second tracking error signal based on the optical signals received by the photo detector using a differential push-pull method;
determining whether a level of the second tracking error signal is equal to or greater than a level of a predetermined threshold signal; and
outputting the second tracking error signal as the tracking error signal when the level of the second tracking error signal is equal to or greater than the level of the predetermined threshold signal.
3. An apparatus to generate a tracking error signal using laser beams reflected from a surface of a compact disc, comprising:
a first input terminal receiving one or more optical detection signals, indicating intensities of the reflected laser beams, that are input;
a first tracking error signal generator that receives the one or more optical detection signals input from the first input terminal and that generates a first tracking error signal based on the input optical detection signals using a differential phase detection method; and
an output terminal through which the first tracking error signal, generated by the first tracking error signal generator, is outputtable.

4. The apparatus of claim 3, further comprising:
a second tracking error signal generator that generates a second tracking error signal based on optical signals received by a photo detector using a differential push-pull method;
a second input terminal through which a selection signal is input; and
a selector that selects one of the first and second tracking error signals in response to the selection signal input from the second input terminal and outputs the selected tracking error signal to the output terminal.

5. The apparatus of claim 4, further comprising:
a comparator that determines whether a level of the second tracking error signal is equal to or greater than a level of a predetermined threshold signal,
wherein the selector selects and outputs the second tracking error signal when the level of the second tracking error signal is equal to or greater than the level of the predetermined threshold signal.

6. The apparatus of claim 3, further comprising:
a second tracking error signal generator that generates a second tracking error signal based on optical signals received by a photo detector using a differential push-pull method;
a second input terminal through which a selection signal is input;
a selector that selects one of the first and second tracking error signals and outputs the selected tracking error signal to the output terminal; and
a controller that controls the selector in response to the selection signal input from the second input terminal and a result of comparing a level of the second tracking error signal with that of a predetermined threshold signal.

7. An optical storage drive to reproduce information recorded on a compact disc, comprising:
an optical source that emits laser beams having wavelengths to reproduce the information from the compact disc;

an optical detector that receives the laser beams reflected from a surface of the compact disc and generates optical detection signals corresponding to intensities of the reflected laser beams; and

a tracking error signal generating unit that generates tracking error signals in response to the optical detection signals generated by a photo detector, and comprises:

a first input terminal to receive the optical detection signals from the optical detector;

a first tracking error signal generator that receives the optical detection signals input from the first input terminal and generates a first tracking error signal based on the optical detection signals using a differential phase detection method; and

an output terminal to which the first tracking error signal generated by the first tracking error signal generator is output.

8. The optical storage drive of claim 7, wherein the tracking error signal generating unit further comprises:

a second tracking error signal generator that generates a second tracking error signal based on the optical signals received by the photo detector using a differential push-pull method;

a second input terminal through which a selection signal is input; and

a selector that selects one of the first and second tracking error signals in response to the selection signal input from the second input terminal and outputs the selected tracking error signal to the output terminal.

9. The optical storage drive of claim 8, wherein the tracking error signal generating unit further comprises:

a comparator that determines whether a level of the second tracking error signal is equal to or greater than a level of a predetermined threshold signal,

wherein the selector selects and outputs the second tracking error signal when the level of the second tracking error signal is equal to or greater than that of the predetermined threshold signal.

10. The optical storage drive of claim 7, wherein the tracking error signal generating unit further comprises:

- a second tracking error signal generator that generates a second tracking error signal based on the optical signals received by the photo detector using a differential push-pull method;

- a second input terminal through which a selection signal is input;

- a selector that selects one of the first and second tracking error signals and outputs the selected tracking error signal to the output terminal; and

- a controller that controls the selector in response to the selection signal input from the second input terminal and a result of comparing a level of the second tracking error signal with a level of a predetermined threshold signal.

11. A lead-in control method of an optical storage drive that uses a differential phase detection method for a digital versatile disc and a differential push-pull method for a compact disc, comprising:

- detecting a level of a tracking error signal generated using the differential phase detection method and a level of an RF signal when a medium loaded into the optical storage drive is the compact disc;

- determining a type of the loaded media based on the level of the tracking error signal generated by the differential phase detection method and the level of the RF signal;

- detecting an amplification gain to obtain the tracking error signal within a dynamic range;

- comparing the amplification gain with a predetermined threshold; and

- performing a lead-in routine using the differential push-pull method when the amplification gain is less than the predetermined threshold, and performing the lead-in routine using the differential phase detection method otherwise.

12. A method of generating a tracking error signal using laser beams reflected from a surface of a compact disc, comprising:

generating optical detection signals corresponding to intensities of the laser beams reflected from the surface of the compact disc; and

generating the tracking error signal based on photo detection signals using a differential phase detection method.

13. The method of claim 12, further comprising:

generating a second tracking error signal based on the optical detection signals using a differential push-pull method;

determining whether a level of the second tracking error signal, which is generated using the differential push-pull method, is equal to or greater than that of a predetermined threshold signal; and

selecting and outputting the second tracking error signal, which is generated using the differential push-pull method, as the tracking error signal when the level of the tracking error signal is equal to or greater than that of the predetermined threshold signal.

14. An apparatus to generate a tracking error signal using laser beams reflected from a surface of a compact disc, comprising:

a first input terminal to receive the optical detection signals from an external optical detector;

a first tracking error signal generator that receives the optical detection signals input from the first input terminal and generates a first tracking error signal based on the optical detection signals using the differential phase detection method; and

an output terminal to which the first tracking error signal, generated by the first tracking error signal generator, is output.

15. The apparatus of claim 14, further comprising:

a second tracking error signal generator that generates a second tracking error signal based on the optical detection signals received by the photo detector using a differential push-pull method;

a second input terminal through which a selection signal is input; and

a selector that selects one of the first and second tracking error signals in response to the selection signal input from the second input terminal and outputs the selected tracking error signal to the output terminal.

16. The apparatus of claim 15, further comprises:

a comparator that determines whether a level of the second tracking error signal is equal to or greater than that of a predetermined threshold signal,

wherein the selector selects and outputs the second tracking error signal when the level of the second tracking error signal is equal to or greater than that of the predetermined threshold signal.

17. The apparatus of claim 14, further comprising:

a second tracking error signal generator that generates a second tracking error signal based on optical detection signals received by the photo detector using a differential push-pull method;

a second input terminal through which a selection signal is input;

a selector that selects one of the first and second tracking error signals and outputs the selected tracking error signal to the output terminal; and

a controller that controls the selector in response to the selection signal input from the second input terminal and a result of comparing the level of the second tracking error signal with that of the predetermined threshold signal.

18. A method of generating a tracking error signal using laser beams reflected from a surface of a compact disc, comprising:

detecting the reflected laser beams using a photo detector;

generating a first tracking error signal based on optical signals received by the photo detector, using a differential phase detection method;

generating a second tracking error signal based on the optical signals received by the photo detector using a differential push-pull method;

determining a level of the second tracking error signal; and

outputting the tracking error signal corresponding to one of the first and second tracking error signals according to whether the level of the second tracking error signal is equal to or greater than a threshold level.

19. An apparatus to generate a selected tracking signal using laser beams reflected from a surface of a compact disc, comprising:

a first input terminal receiving optical detection signals, indicating intensities of the reflected laser beams, that are input;

a first signal generator receiving the optical detection signals input from the first input terminal and generating a first tracking signal based on the input optical detection signals using a differential phase detection method;

a second signal generator receiving the optical detection signals input from the first input terminal and generating a second tracking signal based on the input optical detection signals using a differential push-pull method;

a second input terminal through which a selection signal is input;

a selector selecting one of the first and second tracking signals, as the selected tracking signal, in response to the selection signal input from the second input terminal; and

an output terminal outputting the selected tracking signal.

20. An apparatus to generate a tracking signal using laser beams reflected from a surface of a compact disc, comprising:

first and second photo detectors outputting first and second optical detection signals, respectively, indicating intensities of the reflected laser beams;

a first signal generator receiving first optical detection signals from a first photo detector and generating a first tracking signal based on the first optical detection signals using a differential phase detection method;

a second signal generator generating a second tracking signal based on the first and second optical signals using a differential push-pull method; and

a selector selecting and outputting one of the first and second tracking signals, as the selected tracking signal, according to whether a level of the second tracking signal is equal to or greater than a threshold level.

21. An apparatus to generate a selected tracking signal using laser beams reflected from a surface of a compact disc, comprising:

first and second photo detectors outputting first and second optical detection signals, respectively, indicating intensities of the reflected laser beams;

a first signal generator to generate a first tracking signal based on the first optical detection signals using a differential phase detection method;

a second signal generator generating a second tracking signal based on the first and second optical detection signals using a differential push-pull method; and

a selector selecting and outputting one of the first and second tracking signals, as the selected tracking signal, according to whether a level of the second tracking signal is equal to or greater than a threshold level.

22. An apparatus to generate a selected tracking signal using laser beams reflected from a surface of a compact disc, comprising:

a first signal generator to generate a first tracking signal based on first optical detection signals corresponding to first intensities of the reflected laser beams using a differential phase detection method;

a second signal generator generating a second tracking signal based on the first optical detection signals and second optical detection signals corresponding to the first intensities and second intensities, respectively, of the reflected laser beams using a differential push-pull method; and

a selector selecting and outputting the selected tracking signal according to a level of the second tracking signal.

23. The apparatus of claim 22, further comprising:

a comparator determining whether a level of the second tracking signal is equal to or greater than a level of a threshold signal,

wherein the selector selects and outputs the second tracking signal when the level of the second tracking signal is equal to or greater than the level of the threshold signal.

24. The apparatus of claim 22, further comprising:

a controller controlling the selector in response to a selection signal and a result of comparing the level of the second tracking signal with that of a threshold signal.

25. The apparatus of claim 22, further comprising:

a photo detecting unit to detect the intensities of the reflected laser beams and comprises:

a main photo detector; and

two side photo detectors adjacent to opposite sides of the main detector,

wherein the main detector detects the intensities of a main beam and two side photo detectors detect two side beams, respectively.

26. The apparatus of claim 22, wherein the selected tracking signal is stable for a compact disk having a pit depth of around $\lambda/4$, a non-uniform pit depth and/or a non-uniform track pitch.

27. An optical storage drive to reproduce information recorded on a compact disc, comprising:

- an optical source to emit laser beams having wavelengths to reproduce the information from the compact disc;

- an optical detector to receive the laser beams reflected from a surface of the compact disc and to generate optical detection signals corresponding to intensities of the reflected laser beams; and

- a tracking signal generating unit to generate tracking signals in response to the optical detection signals generated by the optical detector, and comprises:

 - a first photo detector to detect first optical detection signals

 - a first tracking signal generator to receive the first optical detection signals input from the first photo detector and to generate a first tracking signal based on the first optical detection signals using a differential phase detection method.

28. An optical storage drive to reproduce information recorded on a compact disc, comprising:

- an optical source to emit laser beams having wavelengths to reproduce the information from the compact disc;

- first and second optical detectors to receive the laser beams reflected from a surface of the compact disc and to generate first and second optical detection signals, respectively, corresponding to intensities of the reflected laser beams; and

- a tracking signal generating unit to generate first and second tracking signals in response to the first and second optical detection signals, respectively, and comprises:

 - a first signal generator receiving the first optical detection signals input from the first optical detector and generating the first tracking signal based on the first optical detection signals using a differential phase detection method;

 - a second signal generator receiving the second optical detection signals input from the second optical detector and generating the second tracking signal based on the first and second optical detection signals using a differential push-pull method; and

a selector selecting and outputting one of the first and second tracking signals, as a selected tracking signal, in response to a selection signal.

29. An optical storage drive to reproduce information recorded on a compact disc, comprising:

an optical source to emit laser beams to reproduce the information from the compact disc; and

a tracking signal generating unit to generate first and second tracking signals in response to laser beams reflected from the compact disc, respectively, and comprises:

first and second photo detectors outputting first and second optical detection signals, respectively, indicating intensities of the reflected laser beams;

a first signal generator receiving the first optical detection signals from the first photo detector and generating the first tracking signal based on the first optical detection signals using a differential phase detection method;

a second signal generator generating the second tracking signal based on the first and second optical detection signals using a differential push-pull method; and

a selector selecting and outputting one of the first and second tracking signals, as a selected tracking signal, according to whether a level of the second tracking signal is equal to or greater than a threshold level.

30. An optical storage drive to reproduce information recorded on a compact disc, comprising:

an optical source to emit laser beams to reproduce the information from the compact disc;

a tracking signal generating unit to generate first and second tracking signals in response to laser beams reflected from the compact disc, and comprises:

a first signal generator to generate the first tracking signal based on the first optical detection signals using a differential phase detection method;

a second signal generator to generate the second tracking signal based on the first and second optical detection signals using a differential push-pull method; and

a selector to select and output one of the first and second tracking signals, as a selected tracking signal, according to whether a level of the second tracking signal is equal to or greater than a threshold level.

31. An optical storage drive to reproduce information recorded on a compact disc, comprising:

an optical source to emit laser beams to reproduce the information from the compact disc;

a first signal generator to generate a first tracking signal based on first optical detection signals corresponding to the reflected laser beams using a differential phase detection method;

a second signal generator to generate a second tracking signal based on the first optical detection signals and second optical detection signals corresponding to the reflected laser beams using a differential push-pull method; and

a selector selecting and outputting a selected tracking signal according to a level of the second tracking signal.

32. The drive of claim 31, further comprising:

a comparator determining whether the level of the second tracking signal is equal to or greater than a level of a threshold signal,

wherein the selector selects and outputs the second tracking signal when the level of the second tracking signal is equal to or greater than the level of the threshold signal.

33. The drive of claim 31, further comprising:

a controller controlling the selector in response to a selection signal and a result of comparing the level of the second tracking signal with a level of a threshold signal.

34. The drive of claim 31, further comprising:

a photo detecting unit to detect the intensities of the reflected laser beams and comprises:

- a main photo detector; and
- two side photo detectors adjacent to opposite sides of the main detector, wherein the main photo detector detects the intensities of a main beam and the two side photo detectors detect two side beams, respectively.

35. The drive of claim 31, wherein the selected tracking signal is stable for a compact disk having a pit depth of around $\lambda/4$, a non-uniform pit depth and/or a non-uniform track pitch.

36. A lead-in control method of an optical storage drive that uses a differential phase detection method for a digital versatile disc and a differential push-pull method for a compact disc, comprising:

- detecting a level of a tracking signal generated using the differential phase detection method and a level of an RF signal;
- determining a type of the loaded media based on a result of the detecting;
- calculating an amplification gain to produce the tracking signal within a dynamic range;
- and
- performing a lead-in routine using one of the differential push-pull method and the differential phase detection method according to the calculated amplification gain.

37. A lead-in control method of a device to record and reproduce information from a medium, comprising:

- detecting a level of a tracking signal generated using a differential phase detection method and a level of an RF signal;
- determining a type of the loaded media based on a result of the detecting;
- calculating an amplification gain to produce the tracking signal within a range; and
- performing a lead-in routine using one of a differential push-pull method and the differential phase detection method according to the calculated amplification gain.